

CALIFORNIA COASTAL COMMISSION

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STAFF REPORT: REGULAR CALENDAR

APPLICATION FILE NO.: 2-02-001

APPLICANTS: Eugene Metz, Carol Cebe, David Sherbon,
Stephen Bowman, and Richard Carcione.

PROJECT DESCRIPTION: Removal and replacement of a 410-foot section of a
bulkhead on Seadrift Lagoon.

PROJECT LOCATION: Three, 5, 9, 11, and 17 Dipsea Road, Stinson Beach, Marin
County
APNs 195-090-32, -30, -06, -33, and -34

**SUBSTANTIVE FILE
DOCUMENTS:** See Appendix A

1.0 EXECUTIVE SUMMARY

The applicants propose to remove 410 feet of wooden bulkhead on the eastern end of Seadrift Lagoon and replace it with a sheet bulkhead consisting of interlocking, PVC sheet pile armor. The new bulkhead would be located landward of the existing bulkhead. The PVC piles would be 14 to 18 feet long and driven 9 to 13 feet into the sand bottom of the lagoon. Staff recommends that the Commission **deny** permit application 2-02-001 because the proposed project is in conflict with resources protection polices 30230 and 30231 of the Coastal Act.

2.0 STAFF RECOMMENDATION

The staff recommends denial of Coastal Development Permit Application No. 2-02-001.

Motion: *I move that the Commission approve Coastal Development Permit No. 2-02-001 for the development proposed by the applicant.*

Staff Recommendation of Approval

Staff recommends a **NO** vote. Failure of this motion will result in denial of the permit and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of the Commissioners present.

Resolution

The Commission hereby denies a coastal development permit for the proposed development on the ground that the development will not conform with the policies of Chapter 3 of the Coastal Act. Approval of the permit would not comply with the California Environmental Quality Act because there are feasible mitigation measures or alternatives that would substantially lessen the significant adverse impacts of the development on the environment.

3.0 FINDINGS AND DECLARATIONS

The Commission hereby finds and declares as follows:

3.1 Project Location

The project site, located on the filled portion of the sand spit between Dipsea Road and Seadrift Lagoon in Stinson Beach, Marin County, spans across five separate but contiguous parcels that are on the easternmost end of the lagoon (three, 5, 9, 11, and 17 Dipsea Road) and is within the privately maintained, gated community of Seadrift (Exhibit 1, Location Map & Exhibit 2, Vicinity Map). The applicants' parcels are each developed with single-family residences, are approximately 130 feet long and 60 to 130 feet wide, and extend 12 feet into the interior of the lagoon (Exhibit 3, Assessor Parcel Map). The properties are bordered on the north and south by existing residences, the east by Dipsea Road, and the west by Seadrift Lagoon. Seadrift Lagoon is an artificially created interior lagoon located between Dipsea and Seadrift Roads and which encompasses part of Bolinas Lagoon. The waters of Seadrift Lagoon are part of the Gulf of the Farallones National Marine Sanctuary. As with all of the properties located adjacent to Seadrift Lagoon, an existing wooden bulkhead separates the lagoon from the landward portion of the properties. The bulkhead, installed around 1967, is approximately three feet high and consists of creosote treated wooden posts and lagging (Exhibit 4, Site Photograph). Extensive damage and deterioration has occurred within this section of the Seadrift bulkhead. In some areas the wood has deteriorated to such an extent or been washed away that sediment from the parcels is eroding into the lagoon.

3.2 Project Description

The applicants propose to remove the section of the existing bulkhead in front of their properties, which totals approximately 410 linear feet and replace it with a PVC sheet pile bulkhead. The replacement bulkhead would consist of interlocking, PVC sheet pile armor (specifically, a product called ShoreGuard™) and would be placed landward of the existing wooden bulkhead (Exhibit 5, Site Plan and Typical Bulkhead Cross Section). The PVC piles would be 14-18 feet long and driven 9 to 13 feet into the sand bottom of Seadrift Lagoon using a vibrating hammer on a crane which would be located on a barge in the lagoon. Before the proposed bulkhead is installed, the existing bulkhead would be removed using chains attached to the crane that would grasp the wooden pilings and whaler boards and pull the materials out of the sand bottom. The removed pieces of bulkhead to be disposed of off site and the PVC sheet piles would either be contained on the same barge as the crane or on two smaller barges (Exhibit 6, Bulkhead Installation Plan). The barges would be transported by land and launched from a vacant parcel at the west end of Seadrift Lagoon. This vacant parcel is used as a recreational area and for boat trailer storage (Exhibit 7, Barge and Crane Launching Site).

3.3 Coastal Act Issues

3.3.1 Water Quality

Coastal Act Section 30230 states:

Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

Coastal Act Section 30231 states:

The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

Seadrift Lagoon is hydrologically connected with Bolinas Lagoon via two tidal gates located at the west and east ends of Seadrift Lagoon. The tidal gates are used by the Seadrift Association to maintain a certain water level in Seadrift Lagoon. When the gates are open, water from Bolinas Lagoon flows into Seadrift Lagoon via the western tide gate and water from Seadrift Lagoon flows into Bolinas Lagoon through the eastern tide gate. This eastern gate is located approximately one parcel over from the project site.

Bolinas Lagoon is within the Gulf of the Farallones National Marine Sanctuary, one of four national marine sanctuaries in California and one of thirteen in the nation. The Sanctuary was designated in 1981 to protect and manage the 1,255 square miles encompassing the Gulf of the Farallones, Bodega Bay, Tomales Bay, Drakes Bay, Bolinas Bay, Estero San Antonio, Estero de Americano, Duxbury Reef, and Bolinas Lagoon. The approximately 2.2-square-mile (1,400-acre) Bolinas Lagoon contains environmentally sensitive habitat, including wetland and mudflats. Bolinas Lagoon provides an important haul-out and birthing site for harbor seals. In addition, benthic invertebrates and fish in the lagoon support a great diversity and abundance of wintering and migratory shorebirds, waterfowl, gulls, and other water-associated birds (Marin County LCP 1981). Bolinas lagoon is the only designated “Wetland of International Significance” on the Pacific Flyway as determined by the Convention on Wetlands of International Importance in 1998, and was recognized particularly for its waterfowl habitat. Approximately 245 species of birds have been identified at the Lagoon and its surrounding watershed. Twenty-three of these species are considered rare, threatened, or endangered. Shorebirds and waterbirds such as the brown pelican, snowy plover, dunlin, great blue heron, black crowned night heron, willet, sandpiper, and greater sand plover have been observed on the lagoon. Heron and egret are known to nest in the lagoon. Of the fifty or so estuaries that have formed along the Pacific Coast, Bolinas Lagoon is one of only 13 that sustains large numbers of migratory shorebirds. Furthermore, the Bolinas Lagoon Management Plan prepared by Marin County in 1996 also identified three species each of amphibians and mammals that frequent

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Bolinas Lagoon as rare, threatened or endangered (Bolinas Lagoon Ecosystem Restoration 2001). Marin County designates Bolinas Lagoon as a County Nature Preserve. The U.S. Army Corps of Engineers found that Bolinas Lagoon is part of a larger natural habitat complex that is part of or adjoins the Sanctuary, encompassing the Pt. Reyes National Seashore, Golden Gate National Recreation Area, Central California Coast Biosphere Preserve, Mt. Tamalpais State Park, and the Audubon Canyon Ranch Bird Sanctuary (USACOE 1997).

Coastal Act Section 30230 requires that marine resources be maintained, enhanced, and where feasible, restored and provides special protection to areas and species of special biological or economic significance. Coastal Act Section 30231 further requires that the biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of groundwater supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams. The Commission considers Bolinas Lagoon to be a unique and important coastal wetland and finds that any development proposed within the connected Seadrift Lagoon must be undertaken to avoid impacts that would significantly degrade the biological productivity and quality of these connected coastal waters and wetlands consistent with Coastal Act Sections 30230 and 30231. Furthermore, Seadrift community members use Seadrift Lagoon for recreational swimming and non-motorized boating. Thus, it is important that the proposed project protect human health of recreational users of these waters consistent with Section 30231.

At the October 2002 hearing, the Commission raised concerns about the proposed use of PVC sheet piles and their potential to add plastic debris to the marine environment. Since plastic is an inorganic material, it does not biodegrade, but rather continually breaks down into ever-smaller pieces. The presence of plastics in the coastal and ocean environment is both widespread and harmful to human and marine life.

An article, written by Jose G.B. Derraik, entitled “The pollution of the marine environment by plastic debris: a review,” reviews much of the literature published on the topic of deleterious effects of plastic debris on the marine environment. The article states:

The literature on marine debris leaves no doubt that plastics make-up most of the marine litter worldwide. (Derraik 2002)

In support of this statement, the article includes a table that presents figures on the proportion of plastics among marine debris around the world. In most of the locations listed on the table, plastics represented more than 50 percent of the total marine debris found in areas such as beaches, shorelines, surface waters, harbors, and seafloors (Derraik 2002). In the Pacific Ocean, researchers found in the North Pacific Central Gyre, which serves as a natural eddy system to concentrate neustonic material, including plastic, a mean of 334,271 pieces of plastic per square mile (Moore 2001).

Whether found deposited on beaches, floating on surface waters, suspended in the water column or settled on seafloors, plastic debris creates problems for both marine life and human activities. Plastic marine debris affects at least 267 species worldwide, including 86% of all sea turtle

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species, 44% of all sea bird species, and 43% of marine mammal species (Laist 1997). For example, plastics cause significant adverse impacts in seabirds, when birds mistakenly ingest the plastic debris. A study performed in 1988, concluded that seabirds consuming large amounts of plastics reduce their food consumption, which limits their ability to lay down fat deposits and in turn reduces fitness. In addition, ingesting plastics can block gastric enzyme secretion, diminish feeding stimulus, lower steroid hormone levels, delay ovulation, and cause reproductive failures (Derraik 2002). Plastic debris that has settled on the seabed floor also harms the biological productivity of coastal waters. In Derriak's article, he states:

The accumulations of such [plastic] debris can inhibit gas exchange between the overlying waters and the pore waters of the sediments, and the resulting hypoxia or anoxia in the benthos can interfere with the normal ecosystem functioning, and alter the make-up of life on the sea floor. Moreover, as for pelagic organisms, benthic biota is likewise subjected to entanglement and ingestion hazards. (Derraik 2002)

Plastic marine debris may also cause impacts to humans, such as impacting fisherman or recreational boaters by fouling props and jamming cooling intakes.

In a previous action denying CDP File No. E-95-5, the Commission found that a project proposing the use of PVC, among other materials in the marine environment was inconsistent with Coastal Act Section 30230 and 30231 because the materials used for the project, including the PVC plastic, would contribute to marine debris and pose a significant risk of harm to marine resources and to the quality and biological productivity of coastal waters. The findings included information on PVC debris issues related to Tomales Bay and Point Reyes National Seashore (PRNS), coastal areas just north of the proposed project. The report included the following findings:

Johnson's Oyster Farm, an aquaculture operation in Tomales Bay, Marin County, utilizes sections of PVC pipe as a substrate for the culture of oysters. Although Johnson's aquaculture facility is located within the semi-sheltered environment of Tomales Bay, tidal currents have broken up and carried many sections of the PVC pipe out to sea. Eventually, some of the PVC pipe washed up on beaches along the Point Reyes National Seashore and beyond. According to a personal conversation with John Del Osso, Ranger, at the Point Reyes National Seashore, PVC pipe is easily moved about by ocean forces. Once in the surf zone, the PVC can be broken up by the forces of the crashing waves. PVC pipe has been the source of on-going clean-up within the Point Reyes National Seashore.

Unlike the denied application, the applicants do not propose using PVC pipe in the marine environment; however, they are proposing PVC sheet piles. If the proposed PVC sheet piles were to break into pieces, like PVC piping, they would also contribute to the plastic marine debris problem.

The manufacturer of ShoreGuard™, the proposed PVC product, guarantees a warranty of 50 years, which excludes failure, damage, or malfunction resulting from misuse, abuse, negligence, alteration, modification, accident, excessive loads, normal wear and tear, lack of proper maintenance, impact of foreign objects, tornado, hurricane, flood, or fire; however, PVC sheet piles have not been in existence for 50 years. Thus, there are no examples that can be identified which would demonstrate exactly how long the PVC sheet piles would survive in Seadrift

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Lagoon before they would begin to break down. If the proposed bulkhead were installed, the PVC sheet piles would be exposed to ultra violet radiation. The PVC contains stabilizers that are intended to protect the PVC from degradation, which may result from UV exposure.

Notwithstanding the protection provided by the stabilizers or the manufacturers guarantee, the potential does exist that the PVC bulkhead would degrade over time. If the sheet piles were to become brittle, they may splinter upon impact and would introduce PVC debris into the lagoon. PVC debris would cause adverse effects to water quality in Seadrift Lagoon, and may migrate into Bolinas Lagoon and the Pacific Ocean. As discussed Bolinas Lagoon supports a great diversity and abundance of wintering and migratory shorebirds, waterfowl, gulls, and other water-associated birds. PVC debris resulting from the proposed project would degrade the water quality and pose threats to the wildlife of the lagoon. Thus the project would result in significant adverse impacts to the biological productivity and quality of coastal waters inconsistent with Sections 30230 and 30231.

Over time, due to the weathering and recreational uses in and around the lagoon, the PVC bulkhead may breakdown into smaller pieces and contribute to the existing plastic marine debris. Plastics in the marine environment create a significant risk of harm to marine resources and to the quality and biological productivity of coastal waters. The Commission therefore finds that the proposed PVC bulkhead project is inconsistent with Coastal Act Sections 30230 and 30231.

3.3.1.1 Response to public comments received on Polyvinyl Chloride (PVC) and Water Quality Impacts

Commission staff has received comments related to concerns of the environmental and health impacts of the manufacturing and disposal of PVC. However, since neither manufacturing nor disposal of PVC is proposed under CDP Application 2-02-01, these issues are not before the Commission. Disposal of PVC or any other construction materials related to the proposed development within the Coastal Zone would require a coastal development permit, which would provide for Commission review of potential impacts of PVC disposal consistent with Chapter 3 of the Coastal Act.

In addition to concerns related to the production and disposal of PVC, Commission staff has received comments on potential water quality and human health impacts related to the use of PVC in Seadrift Lagoon, which include the following:

- The proposed PVC sheet pile would leach and outgas toxic compounds into the marine environment that may cause significant adverse impacts to marine wildlife and the aquatic environment;
- Vinyl chloride monomer, trace component of PVC, would be released into the environment and cause impacts to human health; and
- The proposed PVC bulkhead would release dioxin if burned.¹

¹ Dioxin is a by-product whenever chlorine gas is used or chlorine-based organic chemicals are burned or processed under reactive conditions.

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3.3.1.1(a) PVC Leachates

PVC is comprised of chlorine, carbon, and hydrogen. To create PVC, mineral oil, natural gas and sodium chloride (salt) are manufactured into ethylene and chlorine, which are synthesized into vinyl chloride monomers (VCM) that are then polymerized to polyvinyl chloride (PVC). Once the PVC is created, additives are combined with the PVC to give the finished product desired qualities such as flexibility, strength, and color.

Individuals are concerned that the additives contained in the proposed PVC sheet pile would leach into Seadrift Lagoon and cause significant adverse impacts to human health, marine wildlife, and the aquatic environment. The comments received by Commission staff focused on two additives: (1) plasticizers, which are used to make PVC flexible and (2) stabilizers, which are used to extend the life of the PVC when it is exposed to heat or ultraviolet light and pigments are added for color. Specifically, the stabilizers and plasticizers of concern include the following:

Plasticizers	Stabilizers
Phthalates	Lead
Bisphenol A	Cadmium
Alkylphenols	Organotins
Alkylphenol Polyethoxlanol	Derivatives of alkylphenol phosphates

The proposed bulkhead would consist of a rigid PVC. Thus, it is logical to conclude that the proposed material does not contain plasticizers. Nevertheless, to ensure that this is the case, Commission staff contacted the manufacturer regarding the above listed plasticizers and was told that the PVC used in ShoreGuard™ does not contain any of the above listed plasticizers, nor does it contain the following stabilizers: lead, cadmium, and derivatives of alkylphenol phosphates (Kantola, pers. comm.) (Wisner 2002). Thus, the use of the aforementioned stabilizers and plasticizers in PVC is not before the Commission for review of consistency with the Chapter 3 policies of the Coastal Act as part of Coastal Development Permit Application No. 2-02-001.

The ShoreGuard™ material does contain organotin stabilizer compounds. Organotins are compounds which contain at least one bond between tin and carbon. There are three major types of tin stabilizers, which are distinguished by their respective alkyl groups: methyl, butyl, and octyl.

Clear distinctions must also be drawn between the tri-organotin compounds (which have three tin-carbon bonds) used as biocides and pesticides, and the mono- and di- organotin compounds, with one and two tin-carbon bonds, respectively, used in stabilizer, catalyst, and glass coating applications. Biocides are, by definition, toxic and tri-organotin compounds that can be a potent endocrine disruptor causing major damage to marine wildlife populations.² However, Tri-

² Endocrine disruptor is an exogenous agent that interferes with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body which are responsible for the maintenance of homeostasis reproduction,

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organotin compounds such as tributyltin (TBT) are not used as PVC stabilizers. Mono- and di-organotins, on the other hand, are much less toxic. In fact, certain mono- and di-organotins have been approved as PVC stabilizers for food contact throughout the world (State of California, Department of Housing and Community Development 1998).

Many of the comments on the project submitted raised concerns with the use of TBT. TBT proved to be a highly effective biocide in preventing the attachment and growth of fouling organisms such as barnacles and tube worms on the hulls of vessels. For this reason, it was widely used in the 1960s and 1970s as a paint additive in antifouling coatings on boats. TBT was initially believed to be toxic only to fouling organisms on the painted surface and the not an environmental risk. However, TBT was later found to cause imposex in mollusks as well as other adverse impacts to aquatic wildlife. In 1988, the United States passed the Organotin Antifouling Paint Control Act, which restricts the use of TBT-based marine antifouling paints to ships greater than 25 meters in length or those with aluminum hulls.

The comments submitted stated that the mono- and di-butyltin compounds used in PVC are contaminated with TBT. This is not the case. Mono- and di-butyltins can exist as PVC stabilizers themselves or as degradation products of TBT. As explained previously, TBT, a tri-organotin, is used either as a biocide or pesticide, and is therefore not a part of the PVC product proposed for use. According to the manufacturer, the ShoreGuard™ product is composed of a mixture of five percent virgin and ninety-five percent recycled PVC resin. The PolyOne Corporation, the supplier of the virgin PVC resin used in the manufacturing of the ShoreGuard™ product, stated in writing that the organotin stabilizer compound used in the virgin PVC resin is at less than 1.0 percent of the chemical make-up of the PVC and is a 50/50 mixture of dimethyltin $[(CH_3)_2Sn(SCH_2COOC_8H_{17})_2]$ and monomethyltin $[(CH_3)Sn(SCH_2COOC_8H_{17})_3]$ (Kantola 2002). The manufacture has not provided documentation on the chemical make-up of the recycled PVC resin; however, the manufacturer has indicated that it is feasible to produce the PVC sheet piles out of one hundred percent virgin PVC resin. It is therefore logical to conclude that neither mono-butyltins nor di-butyltins would be released to the environment from a one hundred percent virgin PVC sheet pile either as TBT breakdown products or as a result of leaching stabilizer because TBT is not a part of the PVC product proposed for use. Since mono-butyltins, di-butyltins, and TBTs are not present in the proposed PVC material, there is no risk that they would leach into the marine environment as a result of the proposed development.

In addition to concerns raised with TBT, dibutyltins, and monobutyltins, Commission staff received general comments about the effects of organotins on human health and the marine environment, which include the following: (1) heavy metals such as organotins, resist environmental breakdown and have become global pollutants; (2) the immunotoxicity of some organotins in animals has raised concerns about organotin effects in humans; and (3) organotins can suppress immunity, disrupt the endocrine system, cause birth defects, damage liver, biioduct and pancreas, and may pose a threat to aquatic organisms.

development and/or behavior. Research is being conducted on the relationship between breast cancer and endocrine disruptors.

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Studies published in the scientific literature show that low concentrations of organotins leach into water from rigid PVC pipes (State of California, Department of Housing and Community Development 1998; Sadiki and Williams 1999). Thus, it is likely that some organotin compounds would leach from the proposed PVC bulkhead when exposed to marine waters. As such, the Commission must evaluate whether the proposed development would be carried out in a manner that would sustain the biological productivity and quality of coastal waters adequate to maintain healthy populations of all species of marine organisms and for the protection of human health as required by Coastal Act Sections 30230 and 30231.

The likelihood that some organotins would leach from the material does not necessarily render the proposed development inconsistent with Coastal Act Sections 30230 and 30231. Rather, the issue is whether leaching of organotins from the proposed bulkhead would cause the biological productivity and quality of coastal waters to become inadequate to maintain healthy populations of all species of marine organisms and/or to be hazardous to human health.

The Commission finds that the leaching of organotins into Seadrift Lagoon as a result of the proposed development would not significantly affect the biological productivity and quality of coastal waters because:

- Organotins are not generally persistent in the environment as they are broken down rapidly through microbial activity;
- The mono- and di-organotins contained in PVC and the eventual breakdown product of inorganic tin are much less toxic than tri-organotins;
- The concentration of organotin compounds released to the lagoon would be substantially below the levels determined to be safe for drinking water and the levels shown to be toxic to aquatic organisms; and
- Extensive studies have found PVC products containing organotin compounds do not pose a significant risk to human health in such applications as drinking water pipes (State of California, Department of Housing and Community Development 1998).

Studies have shown that biological degradation of methyl-, butyl- and octyl-tin compounds occur in the aquatic environment. Specifically for mono- and di-methyltins (the stabilizers used in the proposed bulkhead), their half lives, in the absence of methylating organisms to reverse the demethylation process, are estimated to be less than a few months (Maguire 1991). Other researchers have offered a half-life range of a few days to several weeks (ORTEP). These studies indicate that organotins do break down.

Acute toxicity data for organotin compounds are also available. A Canadian study has shown that concentrations of monomethyltin that inhibit 50% of growth (i.e., EC_{50}) of bacteria, yeasts, *D. magna* and some algae are generally greater than 1 mg/L. Some diatoms, however, are inhibited at concentrations as low as 0.08 mg/L. Nevertheless, the figure of 0.08 mg/L is still 67 times higher than the highest concentration of monomethyltin observed in water. Similarly, EC_{50} for dimethyltin is estimated at greater than 0.07 mg/L, and usually greater than 1 mg/L, depending on the target organisms. Again, the figure of 0.07 mg/L is about 150 times higher than the highest concentration of dimethyltin observed in water. It therefore appears that the mono- and di-methyltin compounds would not have acute toxic effects to aquatic organisms. It should be noted that this study had investigated findings from other researchers and monitoring

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results from harbors, marinas, and shipping channels in Canada and elsewhere. Similar toxicity results appear to hold true for mono- and di- butyltins and octyltins as well. Other studies support these conclusions (Maguire 1991; Walsh et.al. 1985; ORTEP).

In terms of potential chronic effects of organotins on the aquatic environment, a 1993-1994 study of water across Canada concluded that the 13 non-TBT organotin species found appeared to pose no acute or chronic hazards to fresh water or marine organisms (Chau et.al. 1997).

The State's Department of Housing and Community Development (HCD) published a *Draft EIR for CPVC Pipe Use for Potable Water Piping in Residential Buildings* in 1998. The draft EIR examined the potential human and environmental impacts associated with the use of CPVC for potable water piping. CPVC consists of long chains of vinyl chloride, to which chlorine is added. PVC is essentially the parent polymer of CPVC. CPVC is more resistant to chemical attack than PVC and does not soften until it reaches a higher temperature, and thus would be more suitable for use in potable water piping.

CPVC and PVC have been widely used for a variety of things in the existing environment. Some examples include toys, food storage plastics, water filter bodies and garden sprinkler pipe and irrigation pipe commonly used in landscape irrigation and production agriculture. The draft EIR recommended that CPVC be used for potable water piping in residential buildings as well. It had already been approved for that particular use in all of the other 49 states, and many foreign countries.

The National Sanitation Foundation (NSF), a not-for-profit, non-governmental organization, involved in standards development, product certification, education, and risk-management for public health and safety has tested and certified many of the common uses of PVC products. The Maximum Contaminant Levels (MCLs) established by USEPA and Cal DHS form the basis for NSF Standards for Drinking Water System Components Health Effects. The MCLs are levels at which no adverse human health impacts would be expected throughout a lifetime of exposure. The MCLs also incorporate a margin of safety. NSF generally uses 10% of the MCL, which provides an additional margin of safety. For contaminants for which there is no MCL, a risk estimate [Maximum Allowable Level (MAL)] is calculated by NSF, following a standard risk assessment protocol developed in concert with the USEPA.

In laboratory experiments, organotins have been detected in water which has been in contact with CPVC pipe and fittings. Standards for organotins in drinking water have been established by NSF using the MAL approach: Short Term Exposure Level (STEL) of 100 µg/L and Maximum Drinking Water Level (MDWL) of 20 µg/L. The draft EIR stated that no studies found had organotin levels above either of these standards. NSF's extraction tests also yielded organotin concentrations lower than the established standards. It should be noted that these extraction tests were performed at elevated temperatures to actively induce leaching, and so the actual concentrations of organotins in drinking water would be lower than suggested by the test data. The draft EIR concluded that higher concentrations of organotins tended to be a transitory effect of new installations and were not significant. And, leaching occurred more readily in hot water than in cold. The report arrived at a similar "insignificant" determination for

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environmental impacts as a result of CPVC use (State of California, Department of Housing and Community Development 1998).

Based on the literature reviewed, the Commission also finds that the evidence does not support a determination that the PVC bulkhead proposed for use in the aquatic environment would be hazardous to human or ecological health. Organotins, the primary leachates of concern, constitute 1% of the PVC chemical make-up. Studies have shown that even though the leaching of organotins does occur, the leachates tend to break down quickly and do not accumulate to levels approaching the reported effective concentrations for the biological indicators used. Similarly, laboratory extraction tests, employing stringent conditions, on CPVC pipes have yielded leached organotin concentrations below even the conservative human health-based criteria. Therefore, even though organotins would leach from the proposed bulkhead, especially immediately upon installation, mitigating factors in the environment such as the constant flushing and dilution provided by the surrounding water and the fact that the bulkhead would not be subject to temperature extremes as the CPVC pipes used in the extraction tests help ensure that the resultant organotin concentrations in the receiving water would be low and not pose significant adverse impacts to either human or ecological health.

In addition to Commission staff's evaluation of the proposed use of PVC in the marine environment, an independent review of product, regulatory, and environmental data associated with the use of PVC as proposed by the applicants was completed by Stellar Environmental Solutions, Inc. for the Seadrift Association. The review includes responses from various regulatory agencies regarding the use of PVC in the marine environment. The Regional Water Quality Control Board, San Francisco Bay Region, did not have any concerns about potential chemical leaching or any other health and safety issues. Terry Oda, Chief of Standards and Permits, Clean Water Act, for the U.S. EPA did not have any knowledge of EPA environmental concerns or limitations on the use of rigid PVC project in the Seadrift Lagoon. The U.S. Army Corps of Engineers was not aware of any concerns related to leachability and potential environmental impacts to water quality from the PVC product. The U.S. Fish and Wildlife Service not have any environmental concerns about the use of rigid PVC in a lagoon environment (Makdisi 2002).

Therefore, the Commission finds that based on the current information available, the leaching of dimethyltin and monomethyltin from the proposed bulkhead would not cause significant adverse impacts to the biological productivity and quality of coastal waters consistent with Coastal Act Sections 30230 and 30231.

In evaluating the potential cumulative impacts of the proposed development, the Commission must consider reasonably foreseeable future projects. Staff is aware that the Seadrift Association is considering replacing the remaining portions of the Seadrift Lagoon bulkhead with ShoreGuard™. As such, the Commission must consider the potential impacts of the proposed development to the biological productivity and quality of marine waters in combination with the replacement of the entire Seadrift Lagoon bulkhead with ShoreGuard™.

As discussed above, mono- and dimethyltins break down within days to a few months in the environment, and the rate at which these compounds leach from PVC water pipes diminishes

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rapidly within the first 24 hours of contact with water. Recent studies (McLellan, 2002) found that concentrations decreased approximately 50% in the first three days, and 98% over 21 days. Thus, the concentration of organotins that would leach from the section of bulkhead proposed to be replaced under this permit application would substantially decrease within a few days to a few weeks following installation. Therefore, in addition to the fact that the concentrations of organotins that would result in lagoon waters would be substantially below the level found to produce harmful effects to aquatic organisms, the highest concentration of organotins would occur in the short-term only.

The Seadrift Association has not submitted a permit application for the replacement of the remaining portions of the bulkhead for Commission review. As such, it is improbable that such a project, if permitted, would be carried out at the same time as the proposed project. Thus, by the time that any future project to replace the remaining portions of the bulkhead occurs, the short-term higher concentration of organotins associated with the proposed project would be substantially diminished due to environmental break down and decreased rate of leaching.

As discussed above, the highest concentration of organotins found to leach from drinking water pipes is approximately 150 times below the level found to be harmful to the most sensitive aquatic organisms studied for such effects. Although data concerning the rate that organotins leach from rigid PVC in seawater is not available, it is reasonable to conclude based on the foregoing that the proposed development would not result in significant adverse individual or cumulative impacts to the biological productivity or quality of coastal waters. Furthermore, studies have reported a leaching rate of 0.0023% per year for PVC for water passing through pipes (Morton, 1998). Taking the most conservative approach, assuming the unlikely scenario that all of the organotins contained in the PVC bulkheads could continue to leach into the lagoon over time, the concentrations would continue to be far below those reported to be harmful to the most sensitive aquatic organisms.¹ However, it is more reasonable to assume, based on the discussions above, that the future installation of bulkheads would likely occur in phases, and that any concentrations of organotins associated with those installations would also degrade quickly, and not result in any long term impacts to coastal resources.

Based on the foregoing the Commission finds that the proposed development would not result in significant adverse individual or cumulative impacts to the biological productivity or quality of coastal waters.

¹ Assuming 12,000 feet of PVC bulkhead containing 1% organotins by weight:

Panel weight = 5.4 lbs/sq ft

Panel dimension 1 foot x 18 feet (18 Sq ft)

Organotins by weight: .054 lbs/sq ft

Organotins (weight) per panel: 0.972 lbs

Weight of organotins for entire 12,000 linear feet of installation: 11,664 lbs

Weight of organotins (11,664 lbs) in milligrams: 5,290,790,000 mg

Annual organotin leachate from completed installation (at 0.0023%): 121688.17mg/yr

Lagoon volume 90,000,000 gallons (340,650,000 liters)

Concentration of organotins in lagoon from leachate on an annual basis: 0.00035 mg/L

(121688.17mg/340,650,000 liters = 0.00035 mg/L)

3.3.1.1(b) Health Impacts of Vinyl Chloride Monomers (VCM)

The concern has also been raised that vinyl chloride monomer (VCM), a trace component of PVC, would be released into the environment from the proposed bulkhead and cause impacts to human health. Public comments included information on VCM from a company called TurnerToys™, which states, “VCM does not, theoretically, occur in PVC polymer produced with perfect quality control. However, this highly toxic and carcinogenic compound has been found to be a trace component of PVC. There have been reports of VCM detected in drinking water that has been standing for a period of time in PVC water pipe.” TurnerToys™ also states, “the main risk of VCM, however, has been found to be primarily to workers in plants producing PVC or producing PVC resin from the VCM monomer; and also to people living close to such plants”(TurnerToys™). As stated above, the production of PVC is not part of the proposed development and therefore, not before the Commission for review of consistency with the Coastal Act.

However, the information from TurnerToys™ also states that “exposure hazard to users of PVC products is not theoretically inherent in the process, but in fact occurs due to inevitable lapses in production quality control and housekeeping” (TurnerToys™). Literature reviewed by staff indicates that exposure of the general public to VCM is considered very low, unless one lives near a PVC plant. These exposures are a result of direct emissions and effluents from the plastic industries. Average daily intake of vinyl chloride through inhalation by local residents ranges from trace amounts to 2,100 µg/day. The average daily intake of vinyl chloride by the remainder of the population, on the other hand, is minimal and essentially zero (NIH, NIEHS, NTP).

Sustained exposure to high concentrations of vinyl chloride during the manufacturing process causes angiosarcoma of the liver, with inhalation being the most likely route of exposure. Comments received by staff also included case studies on angiosarcoma of the hand for workers routinely exposed to pipes and cement containing PVC (Mohler et. al. 1998). In these latter cases, the individuals were exposed to years of routine dermal contact with the pipes and pipe shavings.

Any potential health risk posed by vinyl chloride would depend on both the chemical’s toxicity and human’s exposure to it. Residents and/or swimmers of Seadrift Lagoon would in no way be subject to the same levels of vinyl chloride exposure as PVC workers. The amount of vinyl chloride uptake by individuals (used along with toxicity to estimate chronic health risks, both carcinogenic and non-carcinogenic) would depend primarily on three factors: (1) chemical concentration in the media that comes in contact with the receptors (i.e., air and water); (2) amount of media that is uptaken or comes in contact with the receptors; and (3) frequency and duration of uptake or contact. The PVC workers mentioned in the examples given either inhaled air with persistently high concentration of vinyl chloride in an environment with limited circulation or handled PVC pipes, exposing their hands to direct skin contact with PVC materials. It can further be assumed that these workers were exposed to vinyl chloride for several hours per day and all the work days in a year, and that kind of media contact was sustained for years of their lives.

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In contrast, the amount of residual VCM on the proposed PVC bulkhead would be relatively small to begin with and would decrease over time. Based on the compound's volatility and low solubility, any VCMs released would most likely end up in the atmosphere and disperse, leaving an insignificant vinyl chloride concentration in the water. The water concentration would be further tempered by dilution with the large volume of water available. Vinyl chloride concentration in the air immediately above and around the proposed bulkhead would be low as well due to the very well-circulated environment and certainly nowhere near the air concentration in a manufacturing facility. It is also safe to assume that Seadrift Lagoon residents and swimmers of the Lagoon would not experience the same level of continuous close contact with media containing vinyl chloride like in a work environment. The duration and frequency of vinyl chloride-polluted air uptake or water contact certainly would not approach several hours per day, 240 days per year (approximate number of work days per year), and several years during a lifetime. This would be true for both residents taking a leisurely walk near the bulkhead or swimmers in the Lagoon.

In conclusion, based on the available information, the Commission finds that any vinyl chloride released from the proposed bulkhead would not result in either the frequency or level of exposure that have been shown to be harmful to human health.

3.3.1.1(c) PVC and Dioxins

Another issue raised by the public is the hazards associated with fire and the burning of PVC. When chlorine-based organic chemicals are burned or produced under reactive conditions, dioxins are formed. Dioxins have been characterized by EPA as likely to be human carcinogens and are anticipated to increase the risk of cancer at background levels of exposure (USEPA PBT). As noted in the public comments received by the Commission, the United States is a signatory to the Persistent Organic Pollutants (POP) Treaty, which bans or severely restricts a group of 12 pesticides and industrial chemicals including dioxins. In addition, when vinyl burns, hydrochloric acid is released. Hydrochloric acid can cause severe burns to skin, eyes, and lungs. If the proposed bulkhead were to catch fire while in the Seadrift Lagoon, it would potentially produce both dioxins and hydrochloric acid, releasing them into the air, and into the water, which would result in significant adverse impacts to the biological productivity and the quality of coastal waters, inconsistent with Coastal Act Section 30231. However, a report prepared by the Ministry of the Environment Denmark, titled *Environmental Aspects of PVC*, stated that the fire performance properties differ from rigid to flexible PVC and that rigid PVC is difficult to ignite and burns only with continuous addition of heat from another source (MED 1995). The proposed material is not only a rigid PVC, but would also be located primarily in water and buried in the sediment of the lagoon. Therefore, there is not significant risk that the proposed bulkhead would catch fire and release dioxins and hydrochloric acid into the air and water.

3.3.1.1(d) Additional PVC concerns

In addition to the four main issues discussed above, Commission staff received various articles related to the health effects of chemical pollutants on humans and wildlife. An article titled, *Body of Evidence: The effects of chlorine on human health*, discusses in-depth the health effects of organochlorines on humans and wildlife (Allsopp et. al. 1995). Organochlorines are chemicals that have at least one chlorine-carbon bond in their structure. Potential health impacts include

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reproductive and developmental effects, effects on the nervous system, immune system and the liver, and cancer. The article includes discussion on the many impacts of dioxins, an organochlorine by-product. As previously mentioned, dioxin is produced when chlorine-based organic chemicals are burned or produced under reactive conditions. In order for dioxins to be released into the environment from the proposed development, the PVC sheet piles would need to be burned. As discussed in Section 3.3.1.1(c), the risk of the proposed development catching fire is assumed to be minimal. Therefore, exposure of humans and wildlife to dioxins by the proposed development is unlikely.

In addition to written comments and articles, Commission staff reviewed two video documentaries that were submitted, titled *Blue Vinyl* and *Bill Moyers "Trade Secrets,"* which discuss issues related to PVC. While the videos address issues related to health impacts of PVC manufacturing, use, and disposal, neither documentaries address nor evaluated the use of PVC as a shoreline protection material in a marine environment and whether such a use would impact the biological productivity and the quality of coastal waters.

Commission staff also received a copy of the Marin County Board of Supervisors Resolution No. 99-168, which encourages the elimination of dioxin emissions and promotes the use of PVC-free plastics. Even though the resolution discourages the use of PVC in Marin County, it does not prevent the Commission from approving the use of PVC as proposed because the resolution is not the standard of review in this case. The standard of review that the Commission must apply to the project is the Chapter 3 policies of the Coastal Act.

Concerned individuals also stated that there are safer alternatives than the proposed material. However, unless PVC is shown to present an unmitigated significant adverse impact to coastal resources inconsistent with the provisions of the Coastal Act, the question of whether PVC is the safest feasible alternative does not raise an issue under the Coastal Act. Coastal Act Sections 30230 and 30231 only require that the proposed development maintain, enhance, and where feasible, restore marine resources and that development not adversely impact the biological productivity and quality of coastal waters. Similar to the question of safer alternatives, is the issue of the percentage of recycled PVC contained in the proposed material. Whether the proposed PVC material is produced from 100% post-consumer waste is not an issue under the Coastal Act unless the proportion of recycled versus virgin PVC contained in the sheet pile were shown to cause significant adverse impacts to biological productivity and quality of coastal waters.

3.4 Alternatives

In a report titled, *Alternative Bulkhead Comparisons of the Seadrift Inner Lagoon Bulkhead*, Nobel Consultants, Inc. evaluates the design, construction, and environmental performance of alternative bulkhead materials (Exhibit 7, *Alternative Bulkhead Comparisons Report*). The report is informative regarding the available options and constraints of the various bulkhead materials; however, it does not evaluate marine debris impacts related to the physical breakdown of the PVC and alternative materials.

Feasible, less environmentally damaging alternative materials such as concrete, steel, and wood are available for bulkhead construction. Concrete, steel, and wood have been used in bulkhead applications longer than PVC, and thus, their performance and lifespan expectancy in a marine environment is better understood.

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The first alternative, concrete, is a very heavy material, and if broken down in a low energy environment, such as Seadrift Lagoon, would settle on the substrate. If concrete debris were subject to wave action, waves may transport it to other areas of the coast; however, its presence and potential migration would not cause impacts to the marine environment. According to the Artificial Reef Subcommittee of the Technical Coordinating Committee Gulf States Marine Fisheries Commission, concrete materials are extremely compatible with the environment and provide excellent surfaces and habitat for the settlement and growth of encrusting or fouling organisms, which in turn provide forage and refuge for other invertebrates and fish (ARS 1997).

Another alternative available to the applicants is wood. Since humans have been using wood in marine environments for centuries its behavior is well known and understood. Wood, is subject to degradation by marine borers and other natural forces, and as a result can be deposited in marine waters as wood debris; however wood, unlike plastic is biodegradable. If untreated or treated with chemicals that are not harmful to the marine environment, wood debris would not cause significant adverse impacts to the biological productivity or quality of coastal waters.

Lastly, the applicants could use steel as an alternative bulkhead material. A refined metal, steel has a natural tendency to corrode and thereby return to the stable state that it exists in nature as iron ore or form iron oxides. Although steel would corrode and release iron into the water, the end products are generally nontoxic, and occur naturally in the environment. Similar to wood, if untreated or treated with chemicals that will not impact the marine environment, steel would be a feasible, less environmentally damaging alternative.

By using alternative bulkhead materials such as concrete, steel, or wood, the proposed project would not contribute to plastic marine debris, or impact the biological productivity and quality of coastal waters, and therefore, would be less environmentally damaging. Therefore, the Commission finds that the proposed development would not be carried out in a manner that would sustain the biological productivity and quality of coastal waters to maintain healthy populations of marine organisms in conflict with Coastal Act Sections 30230 and 30231.

3.5 California Environmental Quality Act (CEQA)

Section 21080.5 (d)(2)(i) of the California Environmental Quality Act (CEQA) states:

The rules and regulations adopted by the administering agency shall require that an activity will not be approved or adopted as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse impact which the activity may have on the environment.

The proposed project, as discussed herein, would have significant adverse environmental impacts to coastal resources. Project alternatives and mitigation measures are available which would substantially lessen these adverse environmental impacts, as discussed in Section 3.4 of this report. The Commission therefore finds that the proposed development is not consistent with section 21080.5 (d)(2)(i) of the CEQA.

EXHIBITS:

1. Location map
2. Vicinity map
3. Assessors Parcel Map

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4. Site photographs
5. Site plan and typical bulkhead cross section
6. Bulkhead installation plan
7. Alternatives Bulkhead Comparisons Report

APPENDIX A: SUBSTANTIVE FILE DOCUMENT

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